R O M B U G

INTERIM

DOCUMENTATION
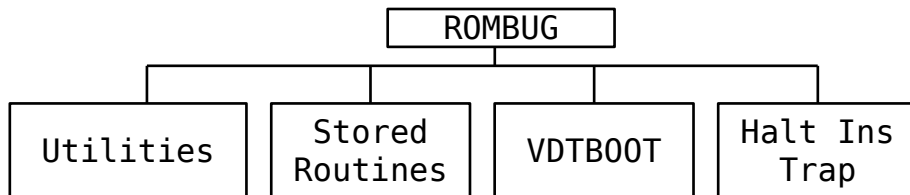
NOTE

The attached narrative, along with troubleshooting information and
overall flow diagrams is currently beeing composed, into reference card
format, by the Sorbus   publication   department. This final doc-
umentation will be distributed as soon as it is available.

R O M B U G

ROM DIAGNOSTICS FOR BASIC FOUR 1200 CPU

   ROMBUG is a firmware service aid which resides in the last three pages
of ROM on a 1200 CPU ROM board. This, board can be identified by the
SORBUS name printed .on the component side. ROMBUG 1s supplied on boards
also containing normal CPU firmware and can therefore function just like
the regular 5 page ROM boards. With power off install replacing standard
ROM boards With ROMBUG. ROMBUG provides the four capabilities shown
below, which can be invoked by using new settings of the sense switches.
All output from ROMBUG is to the VDT connected to channel 0 (T0).

```
                        ┌──────────────┐
                        │   ROMBUG     │
                        └──────────────┘
         ┌───────────────┬──────┴───────┬───────────────┐
  ┌──────────────┐ ┌──────────────┐ ┌──────────┐ ┌──────────────┐
  │              │ │    Stored    │ │          │ │  Halt Ins    │
  │  Utilities   │ │   Routines   │ │ VDTBOOT  │ │    Trap      │
  └──────────────┘ └──────────────┘ └──────────┘ └──────────────┘
```

UTILITIES: Sense Switches 4,2 & 1 Down then CLOCK/RESET/RUN.

   The general purpose utility routines consist of a variety of Firmware
functions which permit extensive CPU, Memory and I/0 device manipulation.
Upon entrance to the Utilities, memory will be cleared from 0 to 400
(HEX), after which the CPU will be deliberately: placed into a HALT
condition. When the RUN switch is again depressed, the current contents.
of the P A B X & O registers will be displayed. A colon (:) will be
displayed as a prompting character to signal that ROMBUG is waiting for
input.

   Each ROMBUG utility function is used by typing a single letter between
'A' and 'P' usually followed by some necessary parameters in HEX
notation. All HEX parameters are separated by either a space or comma.
Input is terminated by carriage return. Each ROMBUG utility function is
described below along with a representative example.

      a) <u>DISPLAY</u> Memory: This operator can be used to display memory
      contents on the VDT. To use this function just type the letter 'D'
      followed by starting and ending address input as HEX values.

         EX: D0,FF cr

         This will display the first 256 bytes of memory, from 00 to
         FF, 16 per line

      b) <u>MODIFY</u> Memory:This operator can be used to change selective
      memory locations. To use this function type the letter 'M' followed
      by the HEX address of the first location to modify terminated by a
      space (A cr will abort the function)
      The current contents will now be displayed. These contents can now
      be modified by inputting new contents (HEX) terminate by a carriage
      return to finish, or a space to advance to the next location.

    EX: M1000 cr
    Memory starting at location 1000.HEX will be modified.
    The contents of location 1000 were changed from 00 to
    FF and the contents of location 1002 from 44 to 77.
    The contents of location 1001 were left unchanged as 33.

c) <u>INIZIALIZE</u> memory: This routine can be used to fill a block of
   memory with a constant. To use this function type the letter 'I'
   followed by a starting and ending memory address then the HEX
   constant.

    EX: I1000,1FFF,22 cr

    Fills memory from 1000 to 1FFF with HEX 22's.

d) <u>GO</u> to any memory location: This operator should be used to start
   machine level program execution at any memory location. To use
   this function, type the letter 'G' followed by the memory address
   (HEX) at which execution is:to begin.

    EX: G2000 cr

    Control will. be passed to the program at memory location
    2000.

e) <u>PRINT</u> Device status: This operator can be used to display status
   of any device on T0. To use this function type the letter 'P'
   followed by the HEX device address. (See device address/status
   table).

    EX: P16 cr

    This will display the most current disc status, which will
    include both primary and secondary status bytes.

f) <u>ALTERNATE</u> seek: This operator can be used to perform the disc
   drive access time adjustments without a disc tester.
   (See Disc Adjustment section). To use this function type the
   letter 'A' followed by two HEX cylinder addresses between which
   the seeking is to take place. CLK/RST/RUN to stop:

    EX: A9,195 cr   (First & Last Cylinders for BBII)

    Will alternately seek between cylinders 9 and 405 on a BBII
    system after displaying the initial drive 0 status, For BBI
    systems last cylinder is CA hex.

ROMBUG internal error checking will abort with '??' error message
if status is incorrect, if a cylinder specified is greater than
the maximum for the type of system, or if the seek operation does
not complete within 180 milliseconds. BB? is displayed if disc
is not ready.

g) CYLINDER seek: This operator can be used to position
   the drive 0 head assembly over any track and select
   either the top or bottom head of the removable disc. Disc
   Read/Write alignment and Burst adjustments can be be done
   without a disc tester using this utility. Once the heads
   have been positioned over the specified cylinder, the
   entire cylinder will be read and resulting status displayed.
   Cylinder data is stored in memory starting at location
   HEX 1000. To use this operator type the letter 'C'
   followed by the (HEX) cylinder address then either a zero
   for the top head or one for the lower head.

    EX: CD2,0 cr

    This will position the heads to. track 210 (decimal)
   on a BBII system. (R/W alignment). This operation
   will result in the following display output:

    BB2 0703 0703
     | | |---- Status after read operation. (see NOTE)
     | |--------- Initial status before seek operation.
     |-------------- System type, either BB1 or BB2 (BB? if
                      disc is not ready)

NOTE: Having an alignment pack installed will result in bad
status. <u>This is a NORMAL condition.</u>
ROMBUG internal error checking will display the "??" error
message if the initial status is bad, if the cylinder address
is greater than the maximum for the system, or if the seek
operation does not complete within 180 milliseconds. If
final status indicates a read error '??' will also be displayed.

h) <u>FIX bad sectors:</u> This Operator can be used to perform
   a type of GET and PUT operation to any disc sector. This
   feature can be used to repair bad disc sectors if the normal
   operating system cannot be used to do so. This operation
   must always be preceded by a cylinder seek which positions
   the heads over the desired cylinder. To use this operator
   type the letter 'F' followed by the (HEX) sector address
   then either a zero for the top head or a one for the
   lower head.

    EX: F10,1 cr

    This will read sector 10 (16 decimal) on the lower
   surface of the currently selected cylinder. This
   operation will result in the following display output:

```
BB2 0703 0703 ?Y 0703
 |    |    |   ||   |-- Status after write.
 |    |    |   ||-----| 'Y'  =input to write back
 |    |    |   |      | 'N'  =do not write back
 |    |    |   |------- Prompting character only.
 |    |    |---------- Status after read.
 |    |-------------- Initial status.
 |------------------- System type either BB1 or BB2.
                        (BB? if disc is not ready)
```

ROMBUG internal error checking will display the error
message if the initial status is bad. If status is bad
following the read operation ROMBUG will attempt to retry
reading the sector up to 128 times, displaying the status
for each retry. Once the sector has been successfully
read it can be rewritten by typing the letter 'Y'. Any
other response will abort the function without rewriting
the sector.

Note: The following ROMBUG utility functions were added after the
      initial field test of the prototype prom set. Due to space
      limitations, they do not provide the same level of prompting
      and simplicity as the other functions. It is therefore
      important that the following descriptions be read and understood
      before using these added capabilities.

   i) <u>EXIT</u> : to disc verification routine: This operator allows
      direct entry to the "canned" disc verification tests which
      follow the VDT and MEM verification routines in the normal
      system integrity test sequence. Since the disc verification
      process requires the first memory board to be operational,
      (starting/ending transfer locations and status location)
      the 'E' operator should not be used unless the MEM test
      has been performed successfully since the CPU was last
      disturbed. This operator allows the disc verification to
      be performed without having to wait for the MEM test to cycle
      on all memory slots. Control is returned to the Utilities
      upon completion. Refer to the "STORED TEST" section for a
      description of the verification sequence. To use this
      Operator just type the letter 'E' in response to the colon (:).

   j) <u>READ BB1 FIXED DISC</u>: This operator can be used to perform
      a read to the fixed disc with display of ending status.
      This operator must be preceded by one of the two normal
      Read (F), Seek/Read (C) routines, in order to set up the
      proper parameters for the 'J' function. The cylinder or
      sector read will be that entered for the preceding C or F
      function and only the ending status will be displayed. This
      routine tests, but does not print, the ending status from
      the proceeding C or F routine. If the previous status was
      bad the operation will be aborted with the '??' message
      The abort process restores the register to acceptable status
      and the 'J' can be retyped to reinitiate the fixed disc read.
      Ending Status from the read is printed to the terminal.

k) <u>READ BB2 FIXED DISC</u>: This operator can be used to perform a read to the fixed disc with display of ending status. This operator works just like the one described previously. With the exception that it is used by typing the single letter 'K'.

STORED ROUTINES: Sense switches 4 & 2 Down then CLOCK/RESET/RUN

The Stored Routines consist of pre-programmed "canned" tests which test three major subsystems: VDT, Memory and Disc. These tests are executed in a progressive fashion, whereby each depends in part, on the successful completion of the previous test. These tests are expected the order they are described below.

a) <u>VDT/CONTROLLER</u>: The purpose of this test is to establish proper operation of channel zero, so as to provide the two-way communication required by the remaining tests. This sec ion of the Stored Routines consists of first establishing transmit capability by outputting all displayable characters The resulting output should be visually verified to the following pattern:

VDT
  !"#$%&'()*+,-./0123456789:;<=><u>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ</u>[\]|-

After verifying this pattern, any character typed will now be read by the CPU and echoed back to the VDT. This should establish minimum Transmit/Receive capability. When a carriage return is typed, control will advance to the memory test.

b) <u>MEMORY:</u> The purpose of this test if to establish the proper operation of each8&K memory board. Eight boards, 64k maximum, are tested unconditionally. Every location in each board is subjected to both an address and data test. The data test involves writing and reading all possible data patterns into each location, using both full and half cycle read and write instructions. The address test writes a unique address into each location (for each 256 bytes). Then, after writing all locations in the board, they are read back for the proper contents. For a 32K system the resulting output would be as follows:

```
MEM
1YY
2YY      ┌─────────────────────────────────────────┐
3YY      │  Left  'Y' = Data test passed.           │
4YY      │  Right 'Y' = Address test passed.        │
5NN      │                                          │
7NN      │  Any failures will be indicated by the 'Y'│
7NN      │  beeing replaced by an 'N'.              │
8NN      │                                          │
         │  'N' = Failed or nonexistent-            │
         └─────────────────────────────────────────┘
```

Once the results of the memory tests have been examined
typing any key will advance control to the disc test.:
NOTE: Because the disc test requires functional memory
in the first slot, the disc test should be run only
if that board is installed and in good working order.
NOTE: The memory test performs a sequence of half cycle
operations which cannot be duplicated in machine level
diagnostics. (TECH TALK #142).

c) Disc VERIFICATION: The purpose of this test is to establish
   the viability of the disc/DMA, Drive and Media area containing
   the operating system information. The verification sequence
   consists of reading the upper and lower surfaces of the first
   ten cylinders on the removable pack. For each read, initial
   and final status,is displayed, along with the cylinder number
   as follows :

```
DSC
BB2 0703 0703                        BB1 0202 0202
BB2 0703 0703 00  | Normal          BB1 0202 0202 00 | Normal
 :    :    :    : | for BBII         :    :    :    : | for BBI
BB2 0703 0703     | system          BB1 0202 0202    | system
BB2 0703 0703 09  | (Mod. 600)      BB1 0202 0202 09 |
  |    |    |    |
  |    |    |    |--- Cylinder number after lower surface read
  |    |    |------- Final status after read
  |    |----------- Initial status before seek
  |--------------- System type either BB1 or BB2.
                    (BB? if Disc not ready)
```

VDT-BOOT: Sense Switches 4 & 1 Down then CLOCK/RESET/RUN.

   This VDT-BOOT capability works just like the 1300 VDT-BOOT,
except that it will operate in full duplex. To enter the machine
language program, type a four character HEX starting address
followed by the HEX string of program characters terminated by a
Motor Bar IV.

    EX: 010004EF47391B660100 IV

    This will input the program to location 100 HEX.

   To start the execution of the program, type the four character
starting address followed by the Motor Bar IV.

    EX: 01000 IV

    This will transfer control to location 100 HEX.

HALT INSTRUCTION TRAP Sense switches 4, 2, & 1 down then RUN only.

  This feature permits branching to the Utility Routines without hitting
the CLOCK and RESET. switches. Upon entrance to the Utilities the current
register contents (P A B X O) are displayed respectively. The utilities
can now be used to examine and display memory and device status. NOTE:
The P register contents have been incremented by one passed the location
of where the halt has occurred. On BB1 systems, running, the GIT
diagnostic with the ROMBUG board installed will cause a branch to the
UTILITIES after the HALT if sense switches 1 and 2 are set. Since GIT is
designed tot test the ROM's anyway, it recommended that the normal ROM
board be used in this case.

DEVICE ADDRESS/STATUS TABLE (All addresses and statuses in Hexadecimal)

CONTROLLER TYPE	DEVICE ADDRESS	NORMAL STATUS
TTY 1-way	00	00
Pgmble 4-way	1B	00
8-way VDT	1B	00
Printer (Centz./Print)	0A (08)	05
Printer (Data Prod)	0A (08)	45
Sync. Communc	2C	See 1300 Ref card
Card Reader	04	" " " "
Mag tape	09	" " " "
Disc/DMA BBI	16	0202 (RDY)
Disc/DMA BBII	16	0703 (RDY 600/400E)
		0F03 (RDY 350/400)

DISC ADJUSTMENTS WITH ROMBUG UTILITIES: (Drive 0 only)
  Old Iomec

	ADJUSTMENT	OPERATION
A0,C8	Access Time Adj.	200 cyl. alternate seek
C69,0	Read/Write Align.	Seek cyl 100, upper=0, lower=1
C6E,0	Read/Write Verify	" " 110, " "
C64,0	Index to Burst Adj.	" " 100, " "

  New Iomec

A0,43	Access time	67 cyl. alternate seek for BB1
A0,86	" "	134 cyl. " " " BB2
A0,C8	" "	200 cyl. " " " BB1
A0,190	" "	400 cyl. " " " BB2
C69,0	Read/Write Align	Seek cyl. 105, upper=0, lower=1, BB1
C6E,0	" " Verify	" " 110 " " BB1
CD2,0	" " Align	" " 210 " " BB2
CDC,0	" " Verify	" " 220 " " BB2
C64,0	Index to Burst	" " 100, BB1
CC8,0	" " "	" " 200, BB2

Caelus:

A0,CB	Transducer Adj.	Alternate seek cyls. 0 to 203.
A0,3	" "	" " " 0 to 3.

    ****** CAELUS READ/WRITE AND BURST SAME AS OLD IOMEC ******